DOWNLOAD PDF DECIPHERING PAST CLIMATES-RECONCILING MODELS AND OBSERVATIONS

Chapter 1 : Verb Tenses: Past, Present, Future | Lesson Plan | racedaydvl.com | Lesson plan | racedaydvl.

Deciphering Past Climatesâ€"Reconciling Models and Observations Forecasts of climate change for the next century are based on general circulation models (GCMs) that have been developed and tuned primarily using twentieth century records, but also with some input based on the understanding of the climate system from the more recent geological.

Verb Tenses Chart Start by showing the students the enlarged Verb Tense Chart, with past, present and future simple tense definitions, descriptions and examples. Have students share their observations whole class. This will help you set the stage for the objective and essential question. Explain that verb tense tells us when an action takes place. The past tense tells what has already happened, the present tense tells us what is happening, and the future tense tells what will happen. Tell students that by the end of the lesson, they will be able to identify the past, present, and future tenses, and write a sentence using a tense. To set the purpose for the lesson, introduce the essential question: How does knowing the past, present and future tense of verbs help us communicate? Have this on the board with the objectives. You will revisit this question at the end of the lesson when students complete the exit ticket. Strand is closing her eyes. Verbalize your thought process through the steps listed below, to model the objective. Write them on the board as you go, or before starting the lesson, so students can reference the steps with their partners, and independently. Stress that writing two additional sentences is important to meet the second objective of the lesson. Refer to the handout of additional sentences. The handout includes eleven sets of three sentences each, one for each verb tense. You only need to model this one set. Model these three sentences on the Verb Tense Assessment Handout: Strand will close her eyes. Strand closed her eyes. Activity Steps Read a sentence. On this step, think aloud using the verb tense chart from the introduction of the lesson Label the verb using this system: Write the appropriate abbreviation above the circled word. Write two sentences that use the other two tenses. Have students follow the steps you modeled to complete sentences on the Verb Tense Assessment handout with a partner. You know your students best. Depending on the group and level of students, you may have certain groups complete 2 sets and others 3 sets. After students have tried sentences with a partner, have a pair of students join together with another pair of students to create groups of 4. Have the pairs compare their work, making any changes if necessary. Be sure to facilitate these discussions so that students are not off-track. Now is the time to catch any errors and decide who may need to be pulled for a small group during independent time. Have one group share one of their three sentences. The class must identify the verb tense used. Students that finish early will prepare a sentence to act out in front of the class. Have each student circle and label the verb. The rest of class will have to guess the verb and tense. Give students who are struggling a copy of the Past, Present, Future Sentences handout. These students can circle and label the verb in each sentence. Assessment 5 minutes Independent Working time can be used as a final assessment of the skill. When analyzing their work, look to see if students first were able to circle and label the correct verb tense. Next, assess if they correctly wrote two new sentences that included different verb tenses: An additional form of assessment is the exit ticket, which will be addressed in the Review and Closing. Review and closing 7 minutes If time permits, allow students to share their newly created sentence. Let the class guess the verb and the verb tense. Go back to the Verb Tense Chart. Ask students to turn to a partner and tell them one new thing they learned from this lesson. Make sure students speak in complete sentences. Review the essential question. Provide the exit ticket handout. The handout includes a scrambled sentence. The students must unscramble the sentence, put it in order, then circle and label the verb and tense. They must also answer the essential question in writing. Related learning resources Workbook Grammar Galore Get your fifth grader clued into advanced grammar.

Chapter 2 : Observation | Define Observation at racedaydvl.com

A method of deciphering past temperatures based on the precise measurement of the ratio between two isotopes of oxygen, O16 and O Analysis is commonly made of seafloor sediments and cores from ice sheets.

Our understanding of the climate system is improved through observations, theoretical studies, and modeling. Teaching this principle is supported by five key concepts. Click here to see them. Therefore, the behavior of the climate system can be understood and predicted through careful, systematic study. Environmental observations are the foundation for understanding the climate system. From the bottom of the ocean to the surface of the Sun, instruments on weather stations, buoys, satellites, and other platforms collect climate data. To learn about past climates, scientists use natural records, such as tree rings, ice cores, and sedimentary layers. Historical observations, such as native knowledge and personal journals, also document past climate change. Observations, experiments, and theory are used to construct and refine computer models that represent the climate system and make predictions about its future behavior. Results from these models lead to better understanding of the linkages between the atmosphere-ocean system and climate conditions and inspire more observations and experiments. Over time, this iterative process will result in more reliable projections of future climate conditions. Our understanding of climate differs in important ways from our understanding of weather. Scientists have conducted extensive research on the fundamental characteristics of the climate system and their understanding will continue to improve. Current climate change projections are reliable enough to help humans evaluate potential decisions and actions in response to climate change. Why is it important? The iterative process of scientific research -- from the collection of observations, review of prior research, analysis of data, modeling of various scenarios, and communication of findings -- is important to convey in order to demystify the process of science and provide a context for how the research is relevant in our everyday lives. Because so few people know an active scientist let alone a climate scientist , and many researchers do not communicate their research to non-technical audiences, it is important to help learners understand some of the basics of the work of climate scientists. These concepts are not unique to climate science; all areas of scientific research share common themes such as: How data is collected through a wide range of tools and techniques. How data is rigorously checked for quality and accuracy, and what scientists mean by "uncertainty" in the data they collect. How models are developed and fine-tuned, with outputs from various models to increase the accuracy of the models. Why "peer review" publications are such an important part of the scientific research process, even though these articles are usually very technical and often hard to understand by a non-expert. What makes this principle challenging to teach? An area of common confusion that educators, students and the public have is that climate scientists disagree as to whether or not climate change is happening, or if it is happening, whether or not humans are the primary cause. Another hurdle is the overall perception that science is overly challenging and that scientific understanding is out of reach for the general public. Thus, educators can take deliberate steps to illuminate how science works and how scientific research is relevant to society. How can I use this principle in my teaching? The process of engaging in science can be accessible to all grade levels and can be brought into the classroom with a variety of approaches. Whether in teams or as individuals, learners can become immersed in the inquiry process of research, observations, data analysis, synthesis and presentation that lies at the heart of all robust science. Middle school students can practice the process of science and see examples of how data is used to reach a scientific conclusion. Students can also follow blogs and field reports from real scientists who are dispatched to interesting locations to unravel compelling research questions. In high school, students can examine data from a widespread area to see if national data matches up with their own observations of their local climate. See the US Historical Climate: To determine how changes in climate are measured both quantitatively and qualitatively, students can analyze tree ring and ice core data and review written and visual historical records. At the introductory undergraduate level, students can engage in field projects, campus-based research, or service learning projects that conduct climate-based research.

Alternatively, students can examine paleoclimate or proxy data to learn about how scientists use these types of data to uncover past climate history. For an example, see Climate and Civilization: Upper-level college students can take part in more in-depth research projects such as working with large datasets such as with the Global Temperatures activity. Students can also use climate models to understand the process of modeling as well as to study the results from the model output.

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Chapter 3 : Observed Change | National Climate Assessment

ErwÃ¤rmung en Understanding Earth's deep past: lessons for our climate future History Introduction -- Lessons from past warm worlds -- Climate transitions, tipping points, and the point of no return -- Deciphering past climates-reconciling models and observations -- Implementing a deep-time climate research agenda.

Share via Email Scenic sunset over the ocean. The first question can be answered in a number of ways. Alternatively, we can measure changes in the net inflow of heat at the top of the atmosphere using satellites. We can also measure the rate of sea-level rise to get an estimate of the warming rate. Since much of sea-level rise is caused by thermal expansion of water, knowledge of the water-level rise allows us to deduce the warming rate. Many studies use combinations of these study methods to attain estimates and typically the estimates are that the planet is warming at a rate of perhaps 0. However, there is some discrepancy among the actual numbers. So assuming we know how much heat is being accumulated by the Earth, how can we predict what the future climate will be? The main tool for this is climate models although there are other independent ways we can study the future. A new study, published by Kevin Trenberth , Lijing Cheng, and others I was also an author answers these questions. The study was just published in the journal Ocean Sciences; a draft of it is available here. In this study, we did a few new things. First, we presented a new estimate of ocean heating throughout its full depth most studies only consider the top portion of the ocean. Second, we used a new technique to learn about ocean temperature changes in areas where there are very few measurements. Finally, we used a large group of computer models to predict warming rates, and we found excellent agreement between the predictions and the measurements. According to the measurements, the Earth has gained 0. Since, the rate is higher 0. To put this in perspective, this is the equivalent of 5,,,, or 5, billion watt light bulbs running continuously day and night. In my view, these numbers are the most accurate measurements of the rate at which the Earth is warming. What about the next question â€" how did the models do? From through , the models on average showed a warming of 0. In my mind, this agreement is the strongest vindication of the models ever found, and in fact, in our study we suggest that matches between climate models and ocean warming should be a major test of the models. Despite these excellent results, scientists want to do better. During a conversation with Dr. Trenberth, he told me: Progress is being made on understanding the energy flows through the climate system as datasets are improved and methods of analyzing the data are being revised and rigorously tested. We can never go back and make observations that were missed, but we can still improve knowledge of how the climate has evolved, even in recent post data-rich Argo times. My other colleague, Dr. Ocean heat content is a vital climate indicator and is a key metric for global warming. How well ocean heating can be assessed by observations and can be simulated by climate models are a cornerstone of climate studies. By collecting the state-of-the-art observational ocean warming estimates and climate model results, this study gives the current status of our warming world and its future heating. We will continue to work hard to improve both measurements and models to better understand the climate change. Me and my colleague Dr. Lijing Cheng in China. A paper published before ours by a world-class group of scientists came to similar conclusions. So too does another study found here. When multiple and independent studies come to similar conclusions, it suggests that the conclusions are robust. Our current warming and future predictions are so very important to understanding this very important topic. Fortunately, this new study advances our knowledge in these areas.

Chapter 4 : Understanding Earth's Deep Past: Lessons for Our Climate Future | Kirk Johnson - racedaydvl.

Introduction --Lessons from past warm worlds --Climate transitions, tipping points, and the point of no return --Deciphering past climates-reconciling models and observations --Implementing a deep-time climate research agenda --Conclusions and recommendations.

Deciphering Past Climatesâ€”Reconciling Models and Observations Forecasts of climate change for the next century are based on general circulation models GCMs that have been developed and tuned primarily using twentieth century records, but also with some input based on the understanding of the climate system from the more recent geological past e. In part, this reflects the high levels of radiometric calibration and temporal resolution subannual to submillennial offered by near-time paleoclimate archives, which are capable of identifying the typically nonlinear components of the climate systemâ€”characterized by rapid response timesâ€”that are relevant to human society. A critical prerequisite for accurate forecasts of future regional and global climate changes based on GCMs, however, is the requirement that these models use parameters that are relevant to the future we seek to better understand. In this context, the recent climate archive captures only a small part of the known range of climate phenomena, since it has been derived from a time dominated by ice dynamics at both poles. As GCMs are transformed into Earth System Models for the Intergovernmental Panel on Climate Change IPCC Fourth Assessment Report, they will encompass vastly more system physics, and deep-time climate studies will offer modelers the only real-world scenarios for testing the full climate response to the large increases in greenhouse gas levels that are projected. As the climate system departs from the conditions captured by these well-studied near-time climate analogues, it is necessary for the scientific Page 82 Share Cite Suggested Citation: Lessons for Our Climate Future. The National Academies Press. Full testing of climate models for these time periods will require evaluation of feedback processes within models, enhanced spatial resolution, and longer simulations to better characterize climate model variability. All of these requirements, especially those for resolution and variability, will require significant computational resources. For deep-time climate systems, the representation of paleogeographic boundary conditions can be a much greater source of uncertainty than it is for simulations based on modern geography. For example, the exceptionally warm high latitudes during all past warm periodsâ€”whether transient or long termâ€”cannot be reproduced by models without invoking unreasonable CO2 levels, revealing the inability of current models to fully capture the processes and feedbacks governing heat transport and retention or the processes that might generate heat in the polar regions under elevated atmospheric greenhouse gas levels Covey and Barron, ; Rind and Chandler, ; Covey, ; Sloan and Pollard, ; Bice et al. Thus, model development, which is based on improving specific processes and climate feedbacks and, in turn, evaluating the impact of these improvements on model simulations, depends on the availability of spatially resolved, robust, deep-time paleoclimate reconstructions of appropriate geochronological resolution and constraint. In addition, the utility of paleoclimate proxies for climate reconstruction and data-model comparisons relies on the proxies being sufficiently well preserved and the existence of an adequate understanding of the underlying processes, sensitivities, and uncertainties captured by these proxies. Constraining the nature e. Indeed, millennial to seasonal signalsâ€”at times calibrated to the orbital timescaleâ€”have been extracted from the sedimentary record spanning hundreds of millions of years e. Determining rates requires very precise time control, particularly if the processes being studied occur at an ecological timescale 1 year to several centuries. One method for such precise time control is by using annually layered sediments in ancient anoxic or hyper-saline basins, as long as a few age control points are present. Quite highly resolved relative timescales can also be achieved using cyclic sequences, with resolutions of a few centuries to several tens of millennia, based on the identification of distinct orbital periods Figure 4. Both annual layers and orbitally tuned records can reveal ecological dynamics, snapshots of natural variability at different parts of Earth history, and the duration of threshold shifts in ecosystems. Orbital cycles can sometimes be tied to astronomically tuned timescales during the past 40 million years to provide excellent absolute timescales. Orbital cycles have been recognized far back in the Phanerozoic sedimentary record and, together with high-resolution U-Pb dating, offer the potential to reconstruct Earth system dynamics in great detail Erwin ; Davydov et al. The ability to precisely and accurately quantify geological time has improved dramatically with recent advances in radiometric dating and interlaboratory cross-calibration e. Some recent radiometric calibrations of the sedimentary record integrate astrochronology, providing Milankovitch-scale resolution through long intervals of time Page 84 Share Cite Suggested Citation: Several epochs and stages of the Phanerozoic have been fully orbitally tuned, presenting the possibility of geochronological resolution at to year scales e. Many of these records, however, await radiometric calibration to the absolute timescale. Page 85 Share Cite Suggested Citation: ETP is the calculated cycle expected if the sediment record integrated the combined eccentricity, tilt and precession cycles. The geomagnetic polarity timescale is shown on the bottom, here calibrated to the astronomical cycles. To maximize this potential, the community is presented with three primary challenges: For terrestrial records that are notoriously geographically fragmented and poorly resolved, this will rely in large part on systematically acquired, targeted continental drilling of continuous and highly resolved records. For many years, these models included only the physical aspects of the atmosphere, dynamic ocean, land, and sea ice components of the climate system. More recently, however, these models have begun to include coupling to a dynamic ice sheet model and prognostic components for biogeochemistry, atmospheric chemistry, dynamic vegetation, and ecology. Thus, global climate models have evolved from physical climate system models to more comprehensive Earth system models that permit more realistic coupling between the physical climate system and the biosphere e. In terms of the mean state, climate system models are able to realistically capture many characteristics of the current climate, such as observed equator-to-pole thermal gradients, large-scale spatial distribution of precipitation patterns, and various aspects of regional climate variability e. Although the more comprehensive Earth system models offer many advantages, many aspects of regional-scale climates are still not captured accurately although see Sewall and Sloan [], Thrasher and Sloan [], for exceptions. Simulating regional-scale phenomena requires the existence of high-resolution paleoclimate boundary data, which may not exist for Page 87 Share Cite Suggested Citation: Over the past 50 years, climate models have evolved to include a hierarchy of approaches to representing the climate system Figure 4. Geochemical box models are used to study the temporal evolution of quantities such as atmospheric CO_2 and oxygen, ocean stable isotopes, and other geochemical variables. These models are based on theoretical expressions of the sources and sinks of a range of geochemical properties, providing global mean information on timescales of tens of thousands to millions of years. Earth system models of intermediate complexity EMICs extend the box model concept to include spatial resolution and are useful tools to study Earth processes for timescales exceeding 10, years. Typically, these models include a detailed two- or three-dimensional ocean model coupled to simplified one- or two-dimensional atmospheric models. The energy balance atmospheric model predicts the geographic distribution of surface temperature and other energetic atmospheric quantities. The ocean model includes a marine biogeochemical component that simulates the chemical state of the ocean. These models include detailed physical and biogeochemical processes that are often missing in the more complex models. However, their major limitation is that the atmospheric components are highly tuned to the present-day world, and they cannot incorporate realistic mechanical and thermodynamic forcing of the atmosphere on the ocean. Overall, these models are of value to look at transient climate change, such as the long-term fate of pCO_2 over a few hundred thousand years. These models are usually composed of three-dimensional representations of the atmosphere, ocean, sea ice, and land systems. These systems are dynamically coupled and allow for feedbacks among the various components. Recently, these fully coupled Earth System Models have begun to include other processes such as atmospheric chemistry, terrestrial and marine biogeochemistry, and ecological models. With recent increases in computational power, atmospheric GCMs are now simulating the climate system on spatial scales of 50 to 75 km Kim et al. Such a hierarchy of climate models is essential for studying climate change on a wide range of timescales from decades to millions of years. Information from the more computationally expensive GCMs can be used as input for the EMICs, which can then be run for hundreds of thousands of years. Additional challenges exist for the modeling of ancient climates, which are characterized by different paleogeography, paleotopography, atmospheric pCO2, solar luminosity levels, and other boundary conditions. At this time, climate models of past periods use certain parameterizations defined for the present-day global climate system, necessarily requiring questionable assumptions about the relevance of present-day conditions to the older parts of the geological record. Similarly, the emission of precursor gases that form atmospheric aerosols is linked to current understanding of atmospheric chemistry because proxies for paleoemissions of gases that could create aerosols, in particular for those that can affect cloud properties such as biologically mediated dimethyl sulfide Henriksson et al. Thus, the definition of boundary conditions inferred from the geological proxy record and the parameterization of physical processes in warmer world models intrinsically come with significant uncertainty. Key boundary conditions that must be prescribed for deep-time or warm world models include the paleogeography of land areas, past vegetation distributions, paleotopography, and ice sheet extent. Coupling to ocean models additionally requires knowledge of paleoeustasy in order to specify the distribution of shallow seas and the paleobathymetry for the deep oceans: However, a greater concern is that the lack of geological record of intervening ocean basins, particularly prior to the Cretaceous, means that longitudinal control is not possible. Promising new approaches to reconstructing paleoaltimetry have been developed in recent years. The application of the fossil leaf stomata index to paleoaltimetry is based on the established relationship between leaf stomata frequency and ambient pCO2 and the predictable, globally conserved decrease in pCO2 with altitude McElwain, The uncertainty, which can reach levels as large as the potential height of the surface Peppe et al. The oxygen isotope compositions of pedogenic minerals Rowley and Currie, ; Forest, ; Sahagian and Proussevitch, and the hydrogen isotope composition of n-alkanes from epicuticular plant waxes preserved in lacustrine deposits Polissar et al. As this proxy is based on systematic trends in the distribution and isotopic composition of modern precipitation with climate and topography, the uncertainty in estimates is dependent on the degree to which the isotopic composition of paleoprecipitation is faithfully recorded by the authigenic formed in situ minerals Blisniuk and Stern, Recent studies have demonstrated that surface uplift influences the regional climate and isotope distribution and thereby severely complicates paleoaltimetry interpretations e. Therefore, ultimately, the accurate reconstruction of paleotopography requires some degree of iteration between modeling and proxy methods since topographic relief strongly affects regional climate patterns, influencing all of the proxy-based estimates Ehlers and Poulsen, The development of oceanic plateaus and oceanic swells, and uncertainty in how the rate of ocean floor production has varied over time Rowley, ; Stein and Stein, , further challenges reconstructions of paleobathymetry and hence sea level change Kominz, Besides eustasy, uncertainties in estimating changes in the rate of ocean floor production also impact estimates of mantle outgassing that have been used to drive carbon cycle models and delineate the evolution of atmospheric pCO2, pO2, and CH4 through the Phanerozoic Berner, , ; Beerling et al. Page 91 Share Cite Suggested Citation: Changes in vegetative land cover directly influence albedo and Earth surface radiation Betts, ; Chase et al. Changes in terrestrial vegetation also lead to changes in evapotranspiration and the hydrological cycle Shukla and Mintz, ; Rind et al. In addition, vegetative land cover both influences and is influenced by soil moisture content, and changes in soil moisture content can have significant climatic effects through shifts in the relative influences of latent heat flux versus sensible heating Alpert et al. Vegetation-climate feedbacks have not yet been fully incorporated into GCMs because of the difficulty of parameterizing the complex, nonlinear interactions that range from cellular scale in physiological approaches to regional or global scale in biome and physical approaches to plant definition Alpert et al. GCMs incorporating vegetation-climate feedbacks, however, generally yield amplified climate responses such as higher climate sensitivities up to 5. The knowledge of the composition and spatial distribution of vegetation on a global scale, prior to the evolution of angiosperms Early Cretaceous and grasslands Cenozoic , however, must be further developed. A far more coordinated effort is needed to expand scientific understanding of fossil plant physiological mechanisms and to synthesize disparate paleobotanical data into more comprehensive and temporally constrained compilations that can be used to refine dynamic vegetation models for climate modeling. Further improvements in scientific knowledge of these physical and ecological boundary conditions will require more detailed analysis of paleomagnetic, paleoclimatic, paleotectonic, and paleontologic data Van der Voo, ; Parrish, ; Kiessling et al. Recent mantle flow simulations suggest that estimates of long-term 10 to million years eustatic sea level changes and the extent of continental flooding based on seismic and backstripping stratigraphic analysis of continental margin successions may reveal substantial mantle flow-induced dynamic topography on passive margins Moucha et al. Furthermore, high-precision geochronological data from depositional and igneous systems worldwide are critical to constrain the ages of key paleogeographic events. In addition to the need to better constrain the physical boundary conditions for global climate models applied to deep-time climates, the concentration of greenhouse gases in particular CO2 in ancient atmospheres and the solar and spectral irradiance must be determined given their fundamental contribution to radiative forcing of the climate system. The current range of uncertainty in atmospheric CO2 and the near-complete lack of knowledge of other greenhouse gases e. Improved proxies for atmospheric greenhouse gases are needed to narrow the uncertainty in the radiative forcing of the climate system. The evolution of the solar irradiance is well constrained by solar theory over timescales of millions of years. However, variations of total solar irradiance are uncertain on timescales ranging from multidecades to multimillennia. The evolution of spectral irradiance, however, is not well constrained over geological time. Changes in spectral radiance affect the vertical deposition of shortwave energy in the atmosphere and the chemical composition of the atmosphere through photolysis processes e. At present, there is no method to determine how the spectral distribution of solar irradiance has changed in the past. Finally, the latitudinal distribution of solar radiation is determined by sun-Earth geometry, and detailed celestial mechanical calculations for the temporal change of obliquity, eccentricity, and precession are limited. Although climate sensitivities incorporate a number of major feedbacks, reconstructions of global warming during past periods of CO2 release indicate that there are additional short- and long-term feedbacks influencing temperature increases during CO2-forced climate change e. Climate sensitivities on deep timescales have been estimated based on paired data for sea surface temperatures SSTs as well as model and proxy-based CO2 reconstructions e. For example, climate sensitivity for the transient Paleocene-Eocene Thermal Maximum PETM warming has been constrained using paleo-CO2 and paleotemperature estimates inferred from stable isotopic values of marine carbonates and biomarkersâ€"these place the climate sensitivity during the greenhouse gas-forced event between a lower bound of 2. Estimates of paleoatmospheric pCO2 beyond the range of ice cores are based on geochemical carbon models and an evolving toolbox of fossil organic and mineral matter proxies. Each of these methods is characterized by unique strengths, yet is limited by uncertainties and sensitivities reflecting the assumptions underlying their approach summarized in FIGURE 4. Page 94 Share Cite Suggested Citation: Geochemical mass balance models e. The highest-precision paleoatmospheric pCO2 estimates, in particular for the Cenozoic and Cretaceous, are based on proxy methods that utilize fossil marine and terrestrial photosynthetic flora: These fossil proxy approaches, however, are based on calibrations using extant taxa or their nearest living relatives, and require the assumption that modern organisms can be used to represent biological responses of extinct organisms to ancient environmentsâ€"an assumption that has been challenged. For the alkenone paleobarometer, interpretation of the photosynthetic carbon isotope effect assumes constancy in the size of phytoplankton haptophyte cells, which may have varied on millennial timescales Henderiks and Pagani,

Chapter 5 : Maps and Models Page

The first transformation was accomplished by ignoring the implications of a long standing distinction between observing and experimenting. To experiment is to isolate, prepare, and manipulate things in hopes of producing epistemically useful evidence. It had been customary to think of observing as noticing and attending to interesting details of things perceived under more or less natural conditions, or by extension, things perceived during the course of an experiment. To look at a berry on a vine and attend to its color and shape would be to observe it. To extract its juice and apply reagents to test for the presence of copper compounds would be to perform an experiment. Contrivance and manipulation influence epistemically significant features of observable experimental results to such an extent that epistemologists ignore them at their peril. The logical empiricists tended to ignore it. A second transformation, characteristic of the linguistic turn in philosophy, was to shift attention away from things observed in natural or experimental settings and concentrate instead on the logic of observation reports. The shift developed from the assumption that a scientific theory is a system of sentences or sentence like structures propositions, statements, claims, and so on to be tested by comparison to observational evidence. Secondly it was assumed that the comparisons must be understood in terms of inferential relations. If inferential relations hold only between sentence like structures, it follows that theories must be tested, not against observations or things observed, but against sentences, propositions, etc. Schlick Friends of this line of thought theorized about the syntax, semantics, and pragmatics of observation sentences, and inferential connections between observation and theoretical sentences. In doing so they hoped to articulate and explain the authoritativeness widely conceded to the best natural, social and behavioral scientific theories. Some pronouncements from astrologers, medical quacks, and other pseudo scientists gain wide acceptance, as do those of religious leaders who rest their cases on faith or personal revelation, and rulers and governmental officials who use their political power to secure assent. But such claims do not enjoy the kind of credibility that scientific theories can attain. The logical empiricists tried to account for this by appeal to the objectivity and accessibility of observation reports, and the logic of theory testing. Part of what they meant by calling observational evidence objective was that cultural and ethnic factors have no bearing on what can validly be inferred about the merits of a theory from observation reports. In response to this rationale for ethnic and cultural purging of the German educational system the logical empiricists argued that because of its objectivity, observational evidence, rather than ethnic and cultual factors should be used to evaluate scientific theories. Less dramatically, the efforts working scientists put into producing objective evidence attest to the importance they attach to objectivity. Furthermore it is possible, in principle at least, to make observation reports and the reasoning used to draw conclusions from them available for public scrutiny. If observational evidence is objective in this sense , it can provide people with what they need to decide for themselves which theories to accept without having to rely unquestioningly on authorities. Francis Bacon argued long ago that the best way to discover things about nature is to use experiences his term for observations as well as experimental results to develop and improve scientific theories Bacon 49ff. The role of observational evidence in scientific discovery was an important topic for Whewell and Mill among others in the 19th century. Recently, Judaea Pearl, Clark Glymour, and their students and associates addressed it rigorously in the course of developing techniques for inferring claims about causal structures from statistical features of the data they give rise to Pearl, ; Spirtes, Glymour, and Scheines But such work is exceptional. Popper , 31 Drawing a sharp distinction between discovery and justification, the standard philosophical literature devotes most of its attention to the latter. Although theory testing dominates much of the standard philosophical literature on observation, much of what this entry says about the role of observation in theory testing applies also to its role in inventing, and modifying theories, and applying them to tasks in engineering, medicine, and other practical enterprises. Theories are customarily represented as collections of sentences, propositions, statements or beliefs, etc. Observations are used in testing generalizations of both kinds. Suppe , So conceived, a theory can be adequately represented by more than one linguistic formulation because it is not a system of sentences or propositions. Instead, it is a non-linguistic structure which can function as a semantic model of its sentential or propositional representations. Suppe , â€” This entry treats theories as collections of sentences or sentential structures with or without deductive closure. But the questions it takes up arise in pretty much the same way when theories are represented in accordance with this semantic account. What do observation reports describe? One answer to this question assumes that observation is a perceptual process so that to observe is to look at, listen to, touch, taste, or smell something, attending to details of the resulting perceptual experience. In either case, observation sentences describe perceptions or things perceived. Observers use magnifying glasses, microscopes, or telescopes to see things that are too small or far away to be seen, or seen clearly enough, without them. Similarly, amplification devices are used to hear faint sounds. But if to observe something is to perceive it, not every use of instruments to augment the senses qualifies as observational. Philosophers agree that you can observe the moons of Jupiter with a telescope, or a heart beat with a stethoscope. But minimalist empiricists like Bas Van Fraassen , 16â€”17 deny that one can observe things that can be visualized only by using electron and perhaps even light microscopes. Their intuitions come from the plausible assumption that one can observe only what one can see by looking, hear by listening, feel by touching, and so on. Investigators can neither look at direct their gazes toward and attend to nor visually experience charged particles moving through a bubble chamber. Instead they can look at and see tracks in the chamber, or in bubble chamber photographs. The identification of observation and perceptual experience persisted well into the 20th centuryâ€”so much so that Carl Hempel could characterize the scientific enterprise as an attempt to predict and explain the deliverances of the senses Hempel , This was to be accomplished by using laws or lawlike generalizations along with descriptions of initial conditions, correspondence rules, and auxiliary hypotheses to derive observation sentences describing the sensory deliverances of interest. Theory testing was treated as a matter of comparing observation sentences describing observations made in natural or laboratory settings to observation sentences that should be true according to the theory to be tested. This makes it imperative to ask what observation sentences report. Even though scientists often record their evidence non-sententially, e. Hempel , This view is motivated by the assumption that the epistemic value of an observation report depends upon its truth or accuracy, and that with regard to perception, the only thing observers can know with certainty to be true or accurate is how things appear to them. For the phenomenalist it follows that reports of subjective experience can provide better reasons to believe claims they support than reports of other kinds of evidence. Worse yet, if experiences are directly available only to those who have them, there is room to doubt whether different people can understand the same observation sentence in the same way. How could you decide whether her visual experience was the same as the one you would use her words to report? Observers do sometmes have trouble making fine pointer position and color discriminations but such things are more susceptible to precise, intersubjectively understandable descriptions than subjective experiences. How much precision and what degree of intersubjective agreement are required in any given case depends on what is being tested and how the observation sentence is used to evaluate it. And similarly for non-sentential records; a drawing of what the observer takes to be the position of a pointer can be more reliable and easier to assess than a drawing that purports to capture her subjective visual experience of the pointer. The fact that science is seldom a solitary pursuit suggests that one might be able to use pragmatic considerations to finesse questions about what observation reports express. Scientific claimsâ€”especially those with practical and policy applicationsâ€”are typically used for purposes that are best served by public evaluation. Furthermore the development and application of a scientific theory typically requires collaboration and in many cases is promoted by competition. This, together with the fact that investigators must agree to accept putative evidence before they use it to test a theoretical claim, imposes a pragmatic condition on observation reports: Feyerabend took this requirement seriously enough to characterize observation sentences pragmatically in terms of widespread decidability. In order to be an observation sentence, he said, a sentence must be contingently true or false, and such that competent speakers of the relevant language can quickly and unanimously decide whether to accept or reject it on the basis what happens when they look, listen, etc. If epistemic trustworthiness requires certainty, this requirement favors the phenomenalists. Philosophers need to address the question of how these two requirements can be mutually satisfied. Is observation an exclusively perceptual process? Many of the things scientists investigate do not interact with human perceptual systems as required to produce perceptual experiences of them. The methods investigators use to study such things argue against the ideaâ€”however plausible it may once have seemedâ€”that scientists do or should rely exclusively on their perceptual systems to obtain the evidence they need. Thus Feyerabend proposed as a thought experiment that if measuring equipment was rigged up to register the magnitude of a quantity of interest, a theory could be tested just as well against its outputs as against records of human perceptions Feyerabend , â€” Feyerabend could have made his point with historical examples instead of thought experiments. A century earlier Helmholtz estimated the speed of excitatory impulses traveling through a motor nerve. To initiate impulses whose speed could be estimated, he implanted an electrode into one end of a nerve fiber and ran a current into it from a coil. The other end was attached to a bit of muscle whose contraction signaled the arrival of the impulse. To find out how long it took the impulse to reach the muscle he had to know when the stimulating current reached the nerve. This meant arranging things so that current from the coil could deflect a galvanometer needle. Assuming that the magnitude of the deflection is proportional to the duration of current passing from the coil, Helmholtz could use the deflection to estimate the duration he could not see ibid. Such devices enable the observer to scrutinize visible objects. The miniscule duration of the current flow is not a visible object. Helmholtz studied it by looking at and seeing something else. Hooke , 16â€”17 argued for and designed instruments to execute the same kind of strategy in the 17th century. Consider functional magnetic resonance images fMRI of the brain decorated with colors to indicate magnitudes of electrical activity in different regions during the performance of a cognitive task. The magnetic force coordinates the precessions of protons in hemoglobin and other bodily stuffs to make them emit radio signals strong enough for the equipment to respond to. When the magnetic force is relaxed, the signals from protons in highly oxygenated hemoglobin deteriorate at a detectably different rate than signals from blood that carries less oxygen. Elaborate algorithms are applied to radio signal records to estimate blood oxygen levels at the places from which the signals are calculated to have originated. There is good reason to believe that blood flowing just downstream from spiking neurons carries appreciably more oxygen than blood in the vicinity of resting neurons. Assumptions about the relevant spatial and temporal relations are used to estimate levels of electrical activity in small regions of the brain corresponding to pixels in the finished image. The results of all of these computations are used to assign the appropriate colors to pixels in a computer generated image of the brain. The role of the senses in fMRI data production is limited to such things as monitoring the equipment and keeping an eye on the subject. Their epistemic role is limited to discriminating the colors in the finished image, reading tables of numbers the computer used to assign them, and so on. If anything is observed, the radio signals that interact directly with the equipment would seem to be better candidates than blood oxygen levels or neuronal activity. The production of fMRI images requires extensive statistical manipulation based on theories about the radio signals, and a variety of factors having to do with their detection along with beliefs about relations between blood oxygen levels and neuronal activity, sources of systematic error, and so on. In view of all of this, functional brain imaging differs, e. And similarly for many other methods scientists use to produce non-perceptual evidence. In their place, working scientists tend to talk about data. Philosophers who adopt this usage are free to think about standard examples of observation as members of a large, diverse, and growing family of data production methods. Instead of trying to decide which methods to classify as observational and which things qualify as observables, philosophers can then concentrate on the epistemic influence of the factors that differentiate members of the family. In particular, they can focus their attention on what questions data produced by a given method can be used to answer, what must be done to use that data fruitfully, and the credibility of the answers they afford. Bogen It is of interest that records of perceptual observation are not always epistemically superior to data from experimental equipment. Indeed it is not unusual for investigators to use non-perceptual evidence to evaluate perceptual data and correct for its errors. For example, Rutherford and Pettersson conducted similar experiments to find out if certain elements disintegrated to emit charged particles under radioactive bombardment.

Chapter 6 : Understanding Earth's Deep Past: Lessons for Our Climate Future | The National Academies P

Understanding Earth's Deep Past provides an assessment of both the demonstrated and underdeveloped potential of the deep-time geologic record to inform us about the dynamics of the global climate system. The report describes past climate changes, and discusses potential impacts of high levels of atmospheric greenhouse gases on regional climates.

The setting was a group of 12 children of mixed sexes, all of mixed abilities such as physical and learning difficulties. The group was well staffed by women with some children having one to one support. The setting is headed by a teacher and the Early Years Foundation Stage Curriculum guides the work, and the children learn through play. I also included my reflections, dilemmas and prejudices with my seminar group. The first session took place after lunch and I placed myself at the back of the room, discreetly tucked into a corner hoping that my presence would not be noticed. How wrong I was! The room was filled with an array of spontaneous discoveries, books, toys, computers, sand, paint and dressing up clothes and the clutter of noise and emotions reminded me of my own home where I have three young children, where exploring the world extends their nascent theories as to how the world works. Initially, I found it very difficult to sit and focus on Anna solely, as I was used to talking and making eye contact with children, and not being able to engage or speak was difficult. For the first session, I watched Anna intently and I had to clear my head of any judgments of her which were purely based on bits of information I had picked up from staff. It was this reflection that helped me focus between fact and feeling and challenging myself on how the information I had been given about Anna had given considerable weight in how I thought she might play and socialize with other children. I needed to separate these two contradictory parts Goldstein, I watched Anna carefully glide from one activity to the next, first playing with the sand letting it quickly sift through her fingers and making shapes and marks with the palms of her hands. She slowly toddled off when a young boy, eager to play more adventurously nudged her out of the way. On several occasions, children came up to me bringing toys, books and requests to go to the toilet, and at one point, a young child stood in front of me for what seemed like a very long time. I replied only briefly to the children and avoided eye contact when possible. My desire to become involved with the children was very strong, and it was difficult to refuse a simple request from a small child. However, remaining in a passive role allowed me to stand back and slow down and examine in detail the relationship with the child. Bridge et al, , p. The method of sitting observing Anna was at times alien to me and having no prescriptive focus other than observe made me feel vulnerable. How I managed my feelings around observing Anna also reminded me of the work by Isabel Menzies Lyth who wrote about anxiety and how its experience, expression and sublimations are a major factor in determining personal and institutional behaviour. I often refer to the work of Isabel Menzies Lyth when I am faced with uncertainties, and it is my acknowledgment and containment of these feelings that will impact on the overall work that I do with children and their families. In the room with Anna, I had to contain my feelings around the observation. Anna continued throughout my observation to drift from one activity to the next. At one point, I observed her clasp the hand of a worker and pull her gently towards the book corner. The worker gently tapped the hand of Anna, letting her know she was aware of the request. At that moment, I thought of how unique and complex children are as they do not have the language to explain how they think and explore the world that surrounds them. By slowing down and observing them, we have the advantage and a willingness to speculate. Ending the hour observation was less problematic than I thought and I quietly put my coat on and said goodbye with a few children holding gaze with me as I left the room. In the next session with Anna, I felt more relaxed and in tune with what I was trying to do. It was much more comfortable not having to put any kind of theory into practice. I had the added luxury of not having paper and pens or an assessment to complete. It was a time to observe Anna and explore my own feelings. Anna made eye contact with me on a few occasions and I would not be convinced that she knew that I was watching her; however, that is purely my interpretation. In this session, Anna lay dozing on and off on a bean bag, and although she already had had a nap earlier, she seemed somewhat tired and lethargic that day. Beside Anna, on a separate beanbag, lay a child with cerebral palsy, and at that moment, I felt a gush of emotion run through me, and I was reminded of my own child with learning and mobility problems. Two children, side by side, one able bodied and the other, confined to a soft cushion. Rustin identifies this problem well and suggests that recognizing feelings and working with this is very important in the work that we do. I am aware as a practitioner, that we risk professional dangerousness if our roles and boundaries are not clearly defined. Our relationships with clients need to be based on objectivity and self awareness. This allows us to step outside our emotional needs and to be sensitive to the needs of others. I believe for any effective intervention, the worker must remain quite distinct and separate, whole and intact. It was good to be able to discuss my feelings with my seminar group and it is Erikson who talks about basic trust as the first stage of the eight stages of man. I believe that talking about observations was now similar to that described by Winnicott as holding and Bion as containing, and what emerged from the seminar group was a secure base where thoughts and feelings could be openly discussed amongst ourselves, and it was the first time that as a seminar group, that we spoke freely and openly about experiences during observations. The remaining sessions observing Anna became enjoyable and watching her play was fascinating as her tiny hands grasped and touched the toys and objects around her. By observing her, I was to enter her world of self wonderment and capture moments by focusing solely on her. I am aware of the importance of endings and although I had clearly given my remit to the staff, I said goodbye to the children and thanked them for allowing me to sit in their class. I think that they were more interested in circle time and the nursery rhymes to notice my quiet departure from the room. Conclusion Observing Anna had brought back the sense of refocusing on the child and their world. Being able to discuss feelings within the seminar group helped to contain hidden ideologies and prejudices within myself. Having no social work task to do was a luxury. So much of social work time is spent on the speed of completing assessments, ticking boxes, and only the neediest of children receive a service. In my view, much is lost to the benefits of observing children. Too often, only a snapshot of a child is all that a social worker can grasp when working with children and much is lost by not having a space for reflective and analytical practice which gives the worker a platform to critically evaluate and challenge their work. I thoroughly enjoyed the experience of observing Anna, and my own criticism is not having more time spent on reflection with the seminar group. International Journal of Psychoanalysis. Theory, Wisdom, Analogue or Art? The Viking Press Inc. Journal of Social Work Practice.

Chapter 7 : Theory and Observation in Science (Stanford Encyclopedia of Philosophy)

A) a brief statement that summarizes past observations and predicts future ones B) a model that explains the underlying reasons for observations and laws C) the equivalent of a scientific opinion which others may disagree with.

While the focus is on changes in the United States, the need to provide context sometimes requires a broader geographical perspective. Additional geographic detail is presented in the regional chapters of this report. Further details on the topics covered by this chapter are provided in the Climate Science Supplement and Frequently Asked Questions Appendices. The chapter presents 12 key messages about our changing climate, together with supporting evidence for those messages. The discussion of each key message begins with a summary of recent variations or trends, followed by projections of the corresponding changes for the future. Copy link to clipboard Key Message 1: Observed Climate Change Global climate is changing and this change is apparent across a wide range of observations. The global warming of the past 50 years is primarily due to human activities. Supporting Evidence Supporting Evidence Process for Developing Key Messages Development of the key messages involved discussions of the lead authors and accompanying analyses conducted via one in-person meeting plus multiple teleconferences and email exchanges from February thru September The authors reviewed 80 technical inputs provided by the public, as well as other published literature, and applied their professional judgment. Key message development also involved the findings from four special workshops that related to the latest scientific understanding of climate extremes. Each workshop had a different theme related to climate extremes, had approximately 30 attendees the CMIP5 meeting had more than , and the workshops resulted in a paper. Description of evidence base The key message and supporting text summarizes extensive evidence documented in the climate science literature. Technical Input reports 82 on a wide range of topics were also reviewed; they were received as part of the Federal Register Notice solicitation for public input. Evidence for changes in global climate arises from multiple analyses of data from in-situ, satellite, and other records undertaken by many groups over several decades. The Climate Science Supplement Appendix provides further discussion of types of emissions or heat-trapping gases and particles, and future projections of human-related emissions. Supplemental Message 4 of the Appendix provides further details on attribution of observed climate changes to human influence. New information and remaining uncertainties Key remaining uncertainties relate to the precise magnitude and nature of changes at global, and particularly regional, scales, and especially for extreme events and our ability to simulate and attribute such changes using climate models. Innovative new approaches to climate data analysis, continued improvements in climate modeling, and instigation and maintenance of reference quality observation networks such as the U. Climate Reference Network http: Assessment of confidence based on evidence There is very high confidence that global climate is changing and this change is apparent across a wide range of observations, given the evidence base and remaining uncertainties. All observational evidence is consistent with a warming climate since the late s. There is very high confidence that the global climate change of the past 50 years is primarily due to human activities, given the evidence base and remaining uncertainties. Recent changes have been consistently attributed in large part to human factors across a very broad range of climate system characteristics. Confidence Level Very High Strong evidence established theory, multiple sources, consistent results, well documented and accepted methods, etc. Many aspects of the global climate are changing rapidly, and the primary drivers of that change are human in origin. Evidence for changes in the climate system abounds, from the top of the atmosphere to the depths of the oceans Figure 2. The sum total of this evidence tells an unambiguous story: Consistent with our scientific understanding, the largest increases in temperature are occurring closer to the poles, especially in the Arctic. Snow and ice cover have decreased in most areas. Atmospheric water vapor is increasing in the lower atmosphere, because a warmer atmosphere can hold more water. Sea levels are also increasing see Key Message Changes in other climate-relevant indicators such as growing season length have been observed in many areas. Worldwide, the observed changes in average conditions have been accompanied by increasing trends in extremes of heat and heavy precipitation events, and decreases in extreme cold. Global annual average temperature as measured over both land and oceans has increased by more than 1. Red bars show temperatures above the long-term average, and blue bars indicate temperatures below the long-term average. The black line shows atmospheric carbon dioxide CO2 concentration in parts per million ppm. While there is a clear long-term global warming trend, some years do not show a temperature increase relative to the previous year, and some years show greater changes than others.

Chapter 8 : A Child Observation Assignment | racedaydvl.com

Chapter 8 Climate Models and Their Evaluation Executive Summary This chapter assesses the capacity of the global climate models used elsewhere in this report for.